Agreement between California Energy Commission and Potter Drilling, Inc.

Title: Development of a Non-Contact Drilling Technology for Geothermal Wells
Amount: $380,000.00
Term: 30 months
PIER Contact: John Hingtgen
RD&D Committee: 2/9/2010

Funding

FY	Program	Area	Initiative	Budget	This Project	Remaining Balance	
09	Electric	Renewables	ARRA	$690,000	$190,000	$0	0%
10	Electric	Renewables	ARRA	$690,000	$190,000	$0	0%

For the 2009 fiscal year, the total Electric budget is $76.6 million, and for the 2010 fiscal year, the total Electric budget is $81.3 million. Within the Renewables program area, the budget is $690,000 for FY 2009 and $690,000 for FY 2010.

Recommendation

Approve this agreement with Potter Drilling, Inc. for $380,000.00. Staff recommends placing this item on the discussion agenda of the Commission Business Meeting.

The Problem

The cost of drilling wells with conventional technologies is a major barrier to the economic viability of Enhanced Geothermal Systems (EGS). Using conventional rotary bit technologies, drilling costs increase exponentially with depth. Broad-based deployment of EGS technology requires boreholes drilled to a depth of 10 km (roughly 30,000 ft) or more, at which point the cost of conventional drilling can constitute more than 60% of total capital expenditure. Recent analyses of EGS well construction have shown that the largest cost drivers include rate of penetration (ROP), tripping time for bit replacement, bottom hole assembly handling time, and casing and completion. Reducing these cost drivers in hard rock environments is necessary to make EGS competitive with other forms of base load energy. In addition, exploratory drilling expenses for both EGS and conventional geothermal energy are high. The cost of a 6,000 ft exploratory wellbore with a 4-inch bottom hole diameter may be as much as one third of the cost of a full production wellbore. These high exploration costs amplify the risks of developing unproven geothermal resources, thereby making geothermal energy difficult to finance within the private sector. Potter Drilling's Hydrothermal Spallation technology is a novel approach to reducing the current high cost of drilling for Enhanced Geothermal Systems (EGS) and geothermal exploration.

Proposed Research

Hydrothermal Spallation technology utilizes a jet of superheated fluid to bore through rock, achieving substantial increases in rate of penetration (ROP) with virtually no mechanical wear on the drilling assembly compared to conventional rotary drilling technology. Increasing ROP through deep hard rock by an order of magnitude, while also eliminating the contact and wear that necessitates drill string tripping, will push EGS deployment across a major economic threshold – one that may be unreachable through incremental advances in conventional rotary drilling. Potter Drilling is the only company in the world to have successfully developed Hydrothermal Spallation drilling, including successfully demonstrating a laboratory prototype drill capable of producing 4-inch boreholes in solid granite. Other laboratory experiments have shown the effectiveness of the technology in a variety of rock types and under pressures ranging from ambient atmospheric pressure to 3,500 PSI (simulating a borehole depth of 7,500 ft).

Research Justification and Goals

This project will develop advanced electricity technologies that reduce or eliminate consumption of water or other finite resources, increase use of renewable energy resources, or improve transmission or distribution of electricity generated from renewable energy resources" (Public Resources Code 25620.1.(b)(4)), (Chapter 512, Statues of 2006)) by:

- The primary goal of this Agreement is to develop a fully-operational, field-ready prototype Hydrothermal Spallation drilling unit that can be used for slim-hole hard rock drilling.

Background

This project was proposed to the US DOE for funding under the American Recovery and Reinvestment Act (ARRA) and was granted an award of $5,000,000 by USDOE within federal FOA 75. As a part of the total project budget of $7,479,243, Potter Drilling proposed Energy Commission funding of $380,000. DOE reviewed a number of geothermal projects and accepted this project for federal funding.

Funding to supplement the ARRA funding was offered by the Energy Commission in PON-08-011 and was approved by the RD&D Committee on July 9, 2009. The Committee directed that individual project awards would be heard again by them for approval. Proposals to DOE were reviewed and scored by Commission staff, and this project was accepted for supplemental funding in PON-08-011.

If approved by the Committee, this item will be presented to the full Commission for approval at a Business Meeting.

Hydrothermal refers here to the action of hot water mechanically acting on the rock in the well bore. Spallation is the removal of the surface layer of bedrock, similar in concept to the exfoliation of skin. Spallation occurs naturally in many igneous rocks, and this technology is to develop an engineered method of spallation.